# Force and Motion

## Motion in one direction

القوة والحركة – الحركة فى اتجاه واحد

الحركة: هى تغير موضع الجسم بمرور الوقت بالنسبة لجسم اخر

**The motion**:-it is the change of object's position as time passes according to the location of another object.

مسار حركة الجسم فى خط مستقيم او منحنى او الحركتين معا

The path of a moving object may be straight, curved or combination of each.

ابسط انواع الحركة فى خط مستقيم واتجاه واحد

- Simplest type of motion: motion in a straight line in one direction.

• تعتبر حركة القطار فى اتجاه واحد لانه يتحرك للامام او الخلف – وليس لاعلى او اسفل

**G.R:** Train motion is considered from motion in one direction: Because it moves forward or backward, but it doesn't move upward or downward.

السرعة: كمية فيزيائية تستخدم لوصف وقياس حركة الجسم

**Speed**

is a physical quantity which is used to describe and measure the motion of object,

العوامل التى تتحكم فى الحركة او السرعة هى المسافة والوقت

**The two factors necessary for the description of motion or speed**

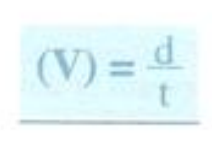
1- The distance that covered by the motion
2- The time taken by the moving body to cover this distance

السرعة : هى المسافة التى يقطعها الجسم فى وحدة الزمن (الثانية-الساعة)

**Speed**:

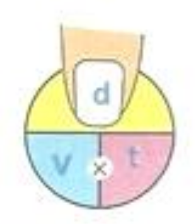
it is the distance moved through a unit time

لقياس السرعة : نقسم المسافة ع الزمن

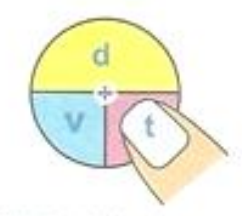





To find the speed



To find the distance



To find the time

السرعة تزداد عندما يقل الزمن – لانه من القانون السرعة تتناسب عكسى مع الزمن

**G.R. the object's speed increases as time decreases to cover the same distance?**

**Because** $V = \frac{d}{t}$ **so the speed of object is inversely proportional with time**

السرعة تزداد عندما تزداد المسافة – لانه من القانون السرعة تتناسب طردى مع المسافة



**G.R. the object's speed increases by increasing the covered distance at constant time?**

**Because** $V = \frac{d}{t}$ **so the speed of object is directly proportional with covered distance**

## *What the meant by*

**1-A train covers a distance 240 km in two hours**

*This means that the train moves with speed equals 120 km/h*

**2- A car moves with speed 150km/h**

*This means that the car covers a distance 150 km in one hour*

**3- The speed of a car equals zero**

*This means that the car is at rest* العربة لا تتحرك

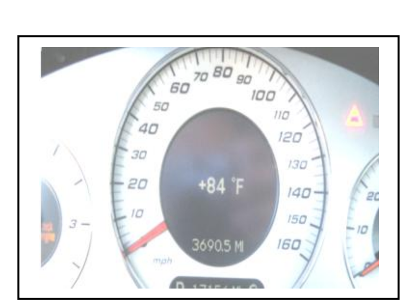
## Problems

**1- Calculate the speed of runner who run 240 m in one minute?**

**Solution** $V = \frac{d}{t} = V = \frac{240}{60} = 4\ m/s$

**2- Find the distance covered by car its speed 20 m/s the time is 20 seconds?**

**Solution** $V = \frac{d}{t}$ = d=v ×t = d=20 ×20 =400 m




| | |
|---|---|
| Measuring device of speed: Speedometer عداد السرعة | Measuring units of speed: (km/h) or (m/s). |
| To change units from (km/h) to (m/s): × *5/18* | To change units from (m/s) to (km/h): × *18/5* |

**The speedometer helps us in identifying the speed of the car directly** العداد يستخدم فى قياس السرعة





# Kinds of speed انواع السرعة

## 1- Regular (uniform) speed السرعة المنتظمة

**Regular speed**

السيارة تتحرك مسافات متساوية على فترات زمنية متساوية

The car covered equal distances in equal periods of time

Or it the change of object's position by equal distances at equal period of time.

| The Regular speed can be calculate from the relation | $V = \frac{d}{t}$ |
|---|---|

d is the distance moved during a period of time t

## What the meant by

**1-An object moves at regular speed 400 km/h>**

This means that the object covers 400 kilometer each 1 hour

## Problems

*1- Calculate the distance covered by an object moves at regular speed 240 km/h during2 hours ?*

**Solution** $V = \frac{d}{t}$ = $d = v \times t$ $= 240 \times 2 = 480$ m

*2- Calculate the time needed for body moves at regular speed 50 km/h to cover distance of 500km ?*

**Solution** $V = \frac{d}{t}$ = $t = \frac{d}{V}$ = $t = \frac{500}{50}$ =10 hours

السرعة غير المنتظمة يتحرك الجسم مسافات غير متساوية ع فترات زمنية متساوية او العكس

## 2- Irregular (non-uniform) speed



***the change of object's position by unequal distances at equal periods of time.***
***Or the change of object's position by equal distances at unequal periods of time***

السيارة لا تستطيع الحركة بسرعة منتظمة بسبب المرور ومشاكل الطريق

**G.R:** Car can't move with regular speed: due to the conditions of the road.

$$\text{Average speed } (\bar{V}) = \frac{\text{total distance moved (D)}}{\text{total time (T)}}$$

Average speed $\bar{V} = \frac{d}{t}$

السرعة المتوسطة هى مجموع المسافات التى يقطعها الجسم مقسوم ع مجموع الازمنة

## Average speed

**It the total distance covered by moving object divided by the total time taken to cover this distance**

## <u>What the meant by</u>

**1-the average speed of a moving car is 40km/h**

This means that the total distance covered by the car divided by the total time taken to cover this distance equals 40

عندما تساوى السرعة المتوسطة السرعة المنتظمة للجسم فإن الحركة تكون منتظمة

1- When the average speed of a moving body equals the regular speed , the motion is described as **<u>regular</u>** motion.



السرعة النسبية

## <u>Relative speed</u>



**المراقب : هو الشخص الملاحظ لحركة السيارة ع الطريق**

The person standing on the side of the road and he observes the speed of the moving cars (this person is called the **observer**).

السرعة النسبية هى سرعة الجسم بالنسبة للمراقب

# Relative speed

It is the speed of moving object relative to an observer

**قياس السرعة النسبية يعتمد ع مكان المراقب (ع الطريق – داخل سيارة)**

**Notices,**

Measuring relative speeds depends on the position of the observer

**لقياس السرعة النسبية 1- المراقب يقف ع جانب الطريق تكون سرعة السيارة النسبية هى الحقيقية**
**2- المراقب داخل سيارة تتحرك فى نفس اتجاه سيارة اخرى فإن السرعة النسبية هى الفرق بين السرعتين**
**3-المراقب داخل سيارة عكس اتجاه سيارة اخرى فإن السرعة النسبية هى مجموع السرعتين**

| **Position - (of an observer)** | **Relative speed observer** | |
|---|---|---|
| **Observer is at rest** | Relative speed = Real speed | Relative speed = Real speed |
| **Observer moves in same direction** | Relative speed = $V_2$ (speed of car) – $V_1$ (speed of observer). | Real speed > Relative speed |
| **Observer moves in opposite direction** | Relative speed = $V_2$ (speed of car) + $V_1$ (speed of observer). | Relative speed > Real speed |



## Problems

***What the meant by ???***

*1- The Relative speed of a moving object to an observer equals its real speed?*
*This means that the observer is at rest*

*2-The Relative speed of an object to moves at 70 km/h to an observer equal 100 km/h?*
*This means that the observer moves in the opposite direction to the moving object with a speed equals 30 km/h*

## G.R.

*1- The moving car seems stable to an observer moves with the same speed and direction?*
*Because the relative speed equals zero ($V_1$-$V_2$=zero)*

Questions on lesson 1



2- the concept of motion is linked to the change of an object's ………. As …….. passes according to the location of another object.

3- The motion in a ……….line in ……… direction is considered the simplest type of motion.

4- The path of a moving object may be ………. , ……..or combination of each.

5- The result of multiplying a speed of a moving object by time =……………………………………

6- Speed measurement units are ………………………………………………. or ……………………………….…

7- A car covers 80 meters in 4 seconds so, it moves at speed equals ………..

8- A train which travels a distance of 360 km with regular speed 120 km/h needs ………….hours to cover this distance.

9- When an object covers equal …………………… At unequal periods of time so, ti moves with ………………………………………… speed.

10- A car moves with irregular speed , its average speed = …………………….. / ……………………….

11- When the average speed of a moving body equals the regular speed , the motion is described as …………………………… motion.

12- Blue car moves on road at speed 80km/h and green car moves in same direction at speed 70 km/h so the passenger in green color observe blue car move with speed ……………………………………………..

13- The measuring of relative speed depends on the ……………………..

*Give reasons*

1 – the object's speed increases by decreasing time needed to cover certain distance?

……………………………………………………………………………………………………………………………………………

2 – we say that an object moves with regular speed?

……………………………………………………………………………………………………………………………………………

3 – a moving car seems to be at rest relative to rider of another moving car beside it with same velocity and direction?

……………………………………………………………………………………………………………………………………………





## *Compare between*

1 – regular speed and irregular speed ?

……………………………………………………………………………………………………………

……………………………………………………………………………………………………………

……………………………………………………………………………………………………………

2 – regular and average speed?

…………………………………………………………………………………………………………

…………………………………………………………………………………………………………

…………………………………………………………………………………………………………

## *Problem*

A racer covered a distance 100 meters of straight track in 10 seconds then, he returned back walking he took 80 seconds to come back to starting point of running .

Calculate the racers average speed :

A: while running     b: while returning     c: during the whole trip.





# Lesson two التمثيل البيانى للحركة

## Graphic representation of moving in a straight line

اهمية الرسم البيانى : التنبؤ بالعلاقة بين الكميات الفيزيائية (المسافة و السرعة)
فهم النتائج العملية – وصف العلاقات الفيزيائية بطريقة سهلة

***Physicists use another mathematical relations like graphs and table*.** **(G.R):** ***In order to:***

**1- Predict relation between physical quantities.** **2- Understand practical results.**
**3- Describe physical phenomena in easier way.**

التمثيل البيانى للسرعة المنتظمة

## Graphic representation of regular (uniform) speed.

الرسم البيانى (المسافة-الزمن) للسرعة المنتظمة خط مستقيم يمر بنقطة الاصل

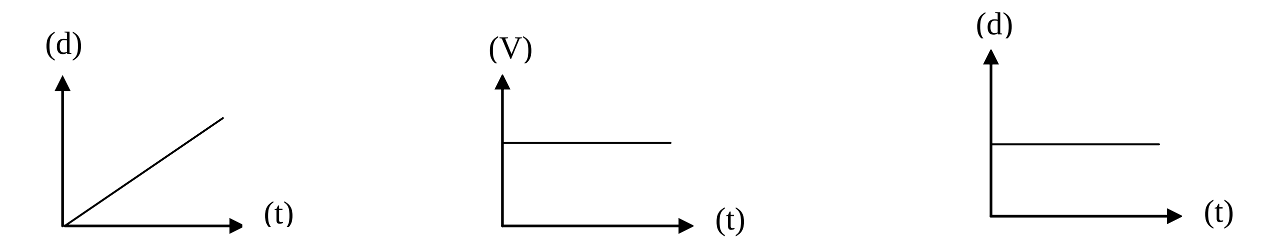
1- The (distance-time) graph for regular – uniform speed is represented by a straight line passing through the origin point

الرسم البيانى (السرعة-الزمن) للسرعة المنتظمة خط مستقيم موازى لمحور الزمن

2- The (speed –time) graph for regular speed at is represented by a straight line parallel to the time axis

الرسم البيانى (المسافة-الزمن) لجسم غير متحرك خط مستقيم موازى لمحور الزمن

3- The (distance –time) graph for object at rest is represented by a straight line parallel to the time axis




Ratio ***d/t*** is constant. **(G.R):** As the speed remains constant as time passes**.**

**Speed = 0 of object at rest (G.R): Because there is no change in the distance.**



# Acceleration

العجلة : مصطلح يعبر عن التغير فى السرعة بالنسبة للزمن

- **When speed of object changes, we need describe that by acceleration**

We use a physical quantity that expresses the change in the car's speed in one second. We call it "***acceleration***"

عندما تزداد سرعة السيارة تكون العجلة تزايدية (السرعة الابتدائية اصغر من النهائية) والعكس صحيح

When the car's speed increases by time ( initial speed < final speed ) the movement is described as "accelerating motion" or positive acceleration

When the car's speed decreases by time ( initial speed > final speed ) the movement is described as "decelerating motion" or negative acceleration

**Acceleration:** is the change of object's speed in one second.
**- Measuring units of Acceleration: ($m/s^2$).**

$$\text{Acceleration (a)} = \frac{\text{Change in speed } (\Delta V)}{\text{Time } (\Delta t) \text{ in which change occurs}}$$

***This means that:***

$$\text{Acceleration (a)} = \frac{\text{Final speed } (V_2) - \text{initial speed } (V_1)}{\text{Time } (\Delta t)}$$

**The symbol ∆ means change of any physical quantity**

*Acceleration*

It is the value of change of an object's speed in one second






وحدة قياس العجلة م/ث2

## The measurement units of acceleration

Acceleration units = meters/second $^2$ = m/s$^2$

## *What the meant by ??!*

1- An object moves with positive acceleration =5m/sec$^2$?

This means that the object's speed increase by 5m/sec each one second

2-Abody moves with negative acceleration =-2m/sec$^2$?

This means that the object's speed decrease by 2m/sec each one second

## *Problems*

1- A car (A) starts movement from rest and then its speed increases to 60 m/s through 5 seconds, while car (B) starts movement from rest and then its speed increases to 80 m/s through 10 seconds

Which car of two cars is moving at greater acceleration?

## *Solution*

Acceleration of car (A)= $\frac{V_2 - V_1}{t} = \frac{60-0}{5}$ =12m/sec$^2$

Acceleration of car (B)= $\frac{V_2 - V_1}{t} = \frac{80-0}{10}$ =8m/sec$^2$

Car (A) moves with greater acceleration than car (B)

العجلة المنتظمة : عند حساب قيمة العجلة فى المرحلتين نجد لها قيمة ثابتة (2م/ث2)

# Uniform acceleration

An object starts its movement from rest and in a straight line

Its speed record each 5 seconds

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Time (t) second | 0 | 5 | 10 | 15 | 20 | 25 | 30 |
| Speed (V) meters/second | 0 | 10 | 20 | 30 | 40 | 50 | 60 |

## *Observation*

The object's speed increase during movement

The object's speed increase by 10 m/s every 5 seconds

The object's acceleration in the 1st 5 sec= $\frac{V_2 - V_1}{t} = \frac{10-0}{5}$ : 2m/sec$^2$

The object's acceleration in the 2nd 5 sec= $\frac{V_2 - V_1}{t} = \frac{20-10}{5}$ = 2m/sec$^2$

**That means acceleration remains constant**



العجلة المنتظمة : عندما يقطع الجسم سرعات متساوية فى ازمنة متساوية (معدل السرعة والزمن يزداد او يقل بمعدل ثابت )

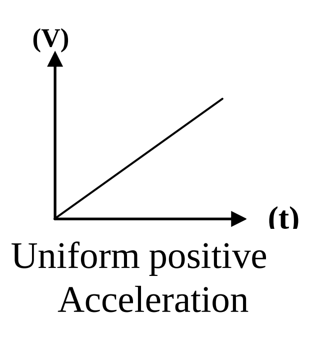
# Uniform acceleration

**It is change of the object's speed by equal values through equal period of time.**

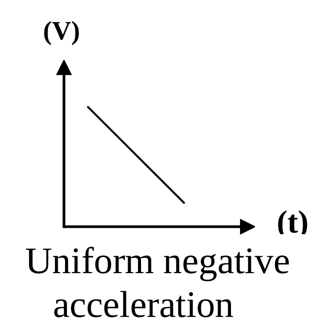
*What the meant by ??!!*

**1- A car moves at uniform acceleration =5m/sec$^2$?**

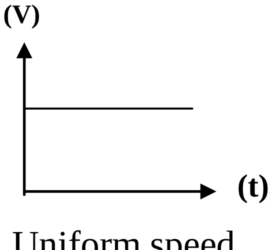
This means that the speed changes with 10 m/s each second




Uniform positive Acceleration




Uniform negative acceleration




Uniform speed acceleration = 0

G.R In a uniform speed acceleration = 0 - As there is no change in the speed

عندما يبدأالجسم الحركة من الثبات تكون السرعة الابتدائية =0
عندما يتوقف الجسم او تستخدم الفرامل تكون السرعة النهائية =0
عندما يسير الجسم ب سرعة منتظمة فإن العجلة =0 (لانه لايوجد تغير فى السرعة)

**Notice :**

When the body start moving from the rest So $V_1$ (initial) = 0
When the body stop – used brakes So $V_2$ (final) = 0
When the body moving with uniform speed So acceleration = 0



# Questions on lesson 2

*1 – physicists use another mathematical relation like ……………..……… and ………………..……….to predict the relation between certain physical quantities.*

*2 –the (distance –time) graph of an object moves at uniform speed is represented by a ……………………….. line passing through the …………………………….point.*

*3 – at regular motion, the distance is …………………..….. proportional with …………………..…………..*

*4 – the (speed-time) graph for motion at uniform speed is represented by a ……………….…. Line parallel to the …………….…… axis.*

*5 – when the distance is measured by meter and time by seconds therefore the measuring unit of speed is …………….……, while the measuring unit of acceleration is ……………………………*

*7 – when the car's speed increases, the movement is described as ……………………..….. motion , while when the car's speed decreases the movement is described as ………………..……motion*

*8 – if the body moves from rest so, its initial speed equals……………………….*

*9 – Acceleration is the change of object's …………………….in one …………………………..…*

*10 – Acceleration (a) = …………………..………/ time (∆ t)*

*11 – Acceleration increases if the object's speed ……………………..….. by time , while it decreases if the object's …………………..…….decreases.*

*12 – when an object moves with deceleration motion, this means that its …………………..……….  Speed is greater than its …………………………… speed.*

*13 – Uniform acceleration is the change of object's ………………………..……….. by equal values through …………………..….. periods of time.*

*14 – the graph for an object moving with regular acceleration is represented by …………..………… on the vertical axis and ……………………………………… on the horizontal axis.*

*<u>Choose the correct answer:</u>*

*1 – distance –time graph for an object moves at uniform speed is a …………………………..*

*A: straight line parallel to time axis.* *B. curved line*

*c. straight line passing through the origin point* *d. zigzag line.*

*2 – when an object's speed increases , the movement is described as ………………………..*



*A: uniform speed,* *b. decelerating motion.* *C. zero acceleration* *d. accelerating motion.*

*3 – the amount of change in speed at a unit time determine ……………………………*
*A: velocity* *b. displacement* *c. distance* *d. acceleration.*

*4 – acceleration measurement units are ………………………*
*A:meter /sec* *b. meter.sec* *c. meter/sec$^2$* *d. meter.sec$^2$*

*5 – a car moves at speed 25 m/sec , then its speed changes to 60 m/sec , after three seconds so, the acceleration by which the car moves is …………………………..*
*A: 10 m/s* *b. 10 m/s$^2$* *c. 20 m/sec$^2$* *d. 30 m/sec*

*6 – the ratio between final speed and initial speed for an object moves with accelerating motion is …………………………………*
*A: more than 1* *b. less than one* *c. equal 1* *d. equal zero.*

*7- when the final speed of a moving object is less than its initial speed, therefore the object motion is described as …………………………*
*A; uniform speed.* *B. accelerating motion* *c. decelerating motion* *d. uniform acceleration.*

***Write the scientific term:***

*1 – the graph for regular motion at uniform speed which is represented by a straight line passing through the origin point.*

……………………………………………………………………………………………………………………………………………….

*2 – the amount of change in body's speed in a second?*

……………………………………………………………………………………………………………………………………………….

*3 – the change of the object's speed by equal values through equal periods of time?*

………………………………………………………………………………………………………………………………………………

***Give reasons for:***

*1 – when the driver of a moving car use the break , we describe the car's movement as decelerating motion?*

………………………………………………………………………………………………………………………………………………

*2 – the body which moves with acceleration can't moves at regular speed?*

……………………………………………………………………………………………………………………………………………….

*3 – the object which moves at uniform speed, its acceleration equals zero?*

………………………………………………………………………………………………………………………………………………

***Problems:***

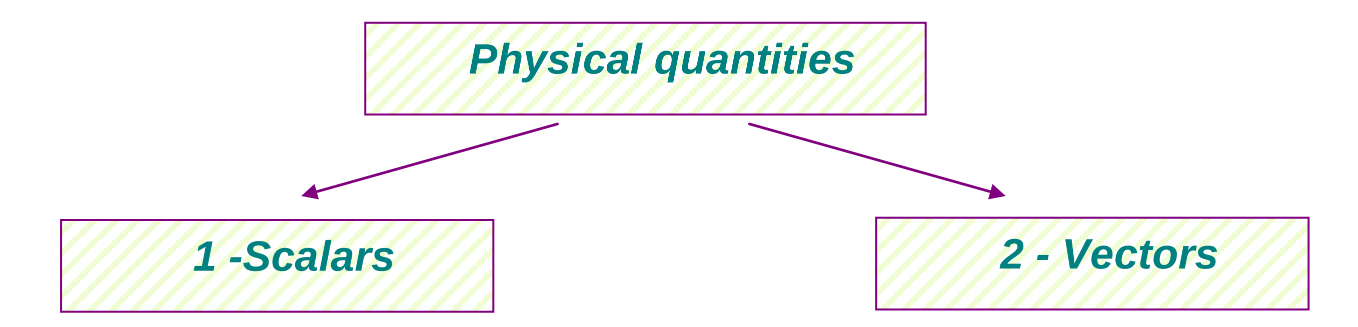
*A car starts moving form rest on a straight road, after 4seconds the speed becomes12 m/s , calculate the acceleration of the car?*

…………………………………………………………………………………………………………………………………………….

…………………………………………………………………………………………………………………………………………….








تنقسم الكميات الفيزيائية الى كميات قياسية وكميات متجهة

الكميات القياسية : يلزم لقياسها معرفة مقدارها فقط (الكتلة – الطول- السرعة القياسية.....)

## 1 – Scalar physical quantities

It is the physical quantity that has magnitude only and has no direction.

| Scalar physical quantities | Its measuring unit |
|---|---|
| Mass | Kilogram (kg) |
| Length | Meter (m) |
| Speed | m/s or km/h |
| Time | Second or hour |
| Energy | Joule |
| Temperature | °C or F |

الكميات المتجهة : يلزم لقياسها معرفة مقدارها واتجاهها (العجلة – القوة- السرعة المتجهة.....)

## 2 – Vector physical quantities

It is the physical quantity that has magnitude and direction.

| Vector physical quantities | Its measuring unite |
|---|---|
| Acceleration | $m/s^2$ |
| Force | Newton |
| Velocity | m/s |
| Displacement | Meter |
| Weight | Newton |





المسافة والازاحة (مسافة فى اتجاه معين – اقصر خط مستقيم بين نقطتين)

## Distance and displacement

المسافة هى طول المسار الفعلى للجسم المتحرك من نقطة البداية للنهاية

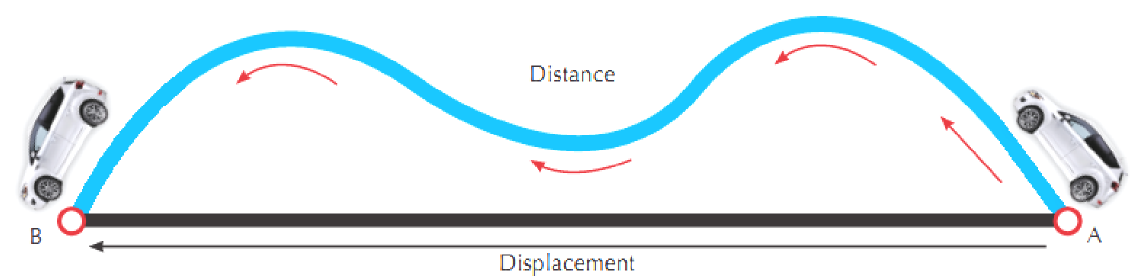
### Distance

It is the actual length of the path that of a moving object takes from the start point to the end point.

الازاحة هى طول اقصر خط مستقيم بين موضعين او نقطتين

### Displacement

It is the length of the shortest straight line between two positions (( primary and final postion))




▲ Figure (12): Difference between distance and displacement.

## *Comparison between distance and displacement.*

| *Points of comparison* | *Distance* | *Displacement* |
|---|---|---|
| *Determined by* | *Magnitude only* | *Magnitude and direction* |
| *Its kind* | *Scalar quantity* | *Vector quantity* |
| *Measuring unit* | *Meter or kilo meter* | *Meter or kilo meter.* |

- ***Distance*** and ***Displacement*** are equal: If object moves in a straight line in one direction.

- **Displacement is zero:** If start point is end point.
-



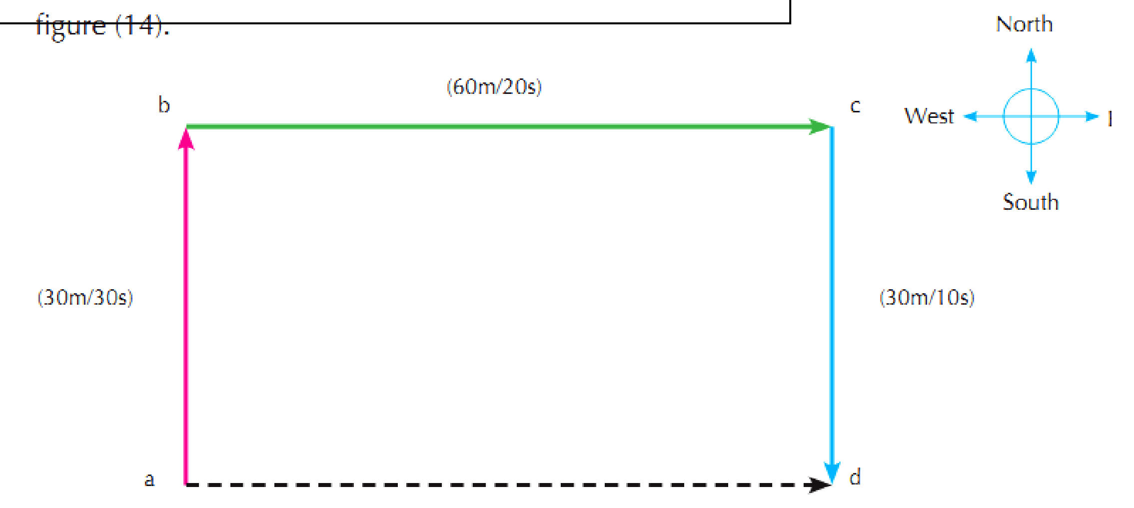
السرعة المتجهة : هى معدل التغير فى الازاحة – هى الازاحة التى يقطعها الجسم فى الثانية (وحدة الزمن)




*it is the rate of change of displacement.*
*Or*
*It is the displacement covered in one second (unite time)*

Average velocity = displacement / total time

figure (14).




**<u>The body moved from a to d</u>**

**<u>Distance:</u> from (a) to (b) then (c) and (d)**

***♣Distance = 30 + 60 + 30 = 120 meter***

**<u>Displacement:</u> from (a) to (d) = direct (shortest) straight line between first and last points**

***♣Displacement = 60 meter in eastward direction.***

***<u>☼ the average speed = 120/60 = 2 m/s</u>*** — distance / time

***<u>☼the average velocity= 60/60= 1 m/s</u>*** — displacement / time

*Comparison between the speed and the velocity*

| ***Points*** | ***Speed*** | ***Velocity*** |
|---|---|---|
| ***Definition*** | ***It is the distance covered in a unit time*** | ***It is the displacement covered in a unite time.*** |
| ***Determine by*** | ***Magnitude only.*** | ***Magnitude and direction.*** |



| Its kind | Scalar | Vector |
|---|---|---|
| Measuring unit | m/s or km/h | M/s or km/h |

- ***Cheetah***: One of the fastest animals, its speed about 27 m/s

**الطيار يتابع السرعة واتجاه الرياح – لحساب كمية الوقود اللازمة لاكمال الرحلة**
**(عندما يطير عكس اتجاه الرياح يستهلك وقود اكثر)**

**Science, Technology and Society:**

**G.R: Pilots take in consideration the velocity and direction of wind:** To calculate the amount of fuel necessary to complete the trip.

## *Questions on unit 1*

### *Complete the following statements:*

14-Physicists use another mathematical relation like ………………… And …………………………… to predict the relation between certain physical quantities.

15-At regular motion, the distance is ……………………… Proportional with …………………………….

16-The (speed- time ) graph for motion at uniform speed is represented by a ………………………………line parallel to the ………… Axis.

17-If the body moves from rest so, its initial speed equals …………………………..

18-Acceleration is the change of object's …………………. in one ………………………..

19-When an object moves with decelerating motion, this means that its …………… Speed is greater than its ………………… speed.

20- Uniform acceleration is the change of object's ………………… by equal values through …………………… Periods of time.

21-The graph for an object moving with regular acceleration is represented by …………………… On the vertical axis and ……………………. on the horizontal axis.

22- All physical quantities are classified into two types which are ……………… And …………………

23- …………….. is the quantity that identifies it and is enough to identify magnitude only.

24- Time is measured in ………………, while ………………….is measured in kilogram.

25- ……. Is the actual length of object's path form the ………….. point to the end one.

26-Velocity is a ……………………… physical quantity and is measured in ………………………



27- Average velocity = ……………………………… / ……………………………
28- The displacement is considered as …………………… Quantity , while density is considered physical quantity.
29- …………………………… is the value of displacement at a unite time and it is a ……………………… Quantity.

## Choose the correct answer:

*1 -………………….. is a physical quantity that is identified by magnitude only.*
*a. velocity b. acceleration c. speed d.force.*

*2 – all of the following are scalar quantities except……………………*
*a. length b. speed. C.temperature. d. weight.*

*3 - ………………. Is a vector quantity and its measuring unit is meter.*
*a. distance b. displacement c. velocity d. force.*

*4– when an object moves in a direct straight line in one direction, therefore ……………………*
*a. distance > displacement. B. distance = displacement.*
*c. distance < displacement. D. displacement = zero.*

*5 - …………… is considered from the fastest wild animals.*
*a. wolf b. lion c.Cheetah d.Elephant.*

*6 – measurement units of velocity is ………………..*
*a. m.sec b. m/sec c. sec /m d. $m/sec^2$*

*7 – the plane which flies against the wind direction ……….. than that which flies in the same direction of wind.*
*a. consumes more fuel b. takes longer time*
*c. its speed increases d. a and b are correct*

## write the scientific term for each of the following:

*10 – the physical quantities that include time , length and mass.*
*11 – the vector quantity which is measured in meter/sec.*
*12 – the measuring unit of displacement.*



*13 – the measuring unit of velocity.*

*14 – the displacement covered in one second.*

## Give reasons for :

*10 – velocity and force are vector quantities.*

…………………………………………………………………………………………………………………………………………..

*11 – distance is a scalar quantity, while displacement is a vector quantity.*

…………………………………………………………………………………………………………………………………………

*12 – when an object moves, where its start point is the end point, its velocity is zero.*

…………………………………………………………………………………………………………………………………………

*13 – pilots take in consideration the velocity of the wind.*

…………………………………………………………………………………………………………………………………………..

## Compare between:

*5 – distance and displacement.*

………………………………………………………………………………………………………………………………………………………

……………………………………………………………………………………………………………………………………………………….

*6 – speed and velocity.*

………………………………………………………………………………………………………………………………………………………

………………………………………………………………………………………………………………………………………………………..





# Unit (2): Lesson (1): Mirrors

انعكاس الضوء : ظاهرة رجوع الضوء ل نفس الوسط عندما يقابل سطح عاكس

**Light reflection**: phenomenon of light bouncing off in the same medium when it strikes reflecting surface.

| | | | |
|---|---|---|---|
| **Incident light ray** | Light ray that falls on reflecting surface | **Reflected light ray** | Light ray that bounces from the reflecting surface |
| **Incidence angle** | Angle between incident light ray and the normal | **Angle of reflection** | Angle between reflected light ray and the normal |

- قانونا الانعكاس : زاوية السقوط=زاوية الانعكاس – الشعاع الساقط والمنعكس والعمود فى مستوى واحد عمودى ع السطح العاكس

- **Light reflection is governed by two laws**:

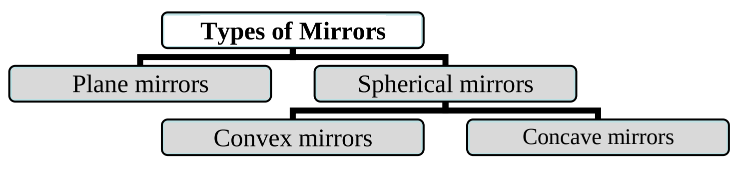
**1-** Angle of incidence = Angle of reflection.

**2-** Incident light ray, reflected light ray and normal to reflecting surface at point of incidence all lie in one plane perpendicular to reflecting surface.

3- الشعاع الساقط عمودى ينعكس ع نفسه لان زاوية السقوط = الانعكاس = صفر

- **G.R:** Incident light ray which falls perpendicular on a reflecting surface, reflects on itself: As incidence angle and reflection angle equal zero.

- انواع المرايا : مستوية – كرية (محدبة – مقعرة)




خصائص الصورة فى المرآة المستوية : معتدلة – تقديرية (لايمكن استقبالها ع حائل) – معكوسة – حجم الصورة =حجم الجسم – بعد الجسم = بعد الصورة عن المرآة المستقيم الواصل بين الجسم وصورته عمودى ع سطح المرآة

**Properties of image formed by a plane mirror**:

| | | | | | |
|---|---|---|---|---|---|
| Erect | Virtual | Reversed (laterally inverted) | Image's size = object's size | Distance between object and mirror = distance between image and mirror | Straight line joining object and image is perpendicular to mirror's surface |

- كلمة الاسعاف تكتب معكوسة – لتظهر للسائقين فى المرآة صحيحة

- **G.r: Ambulance written converted**: to appear correct in cars' mirrors in front of it.

المرآة الكرية : السطح العاكس لها جزء من الكرة – المقعرة هى الجزء الداخلى من الكرة – المحدبة هى الجزء الخارجى من الكرة

| | |
|---|---|
| **Spherical mirror** | : mirror, its reflecting surface is a part of a hollow sphere. |
| **Concave mirror** | **:** mirror, its reflecting surface is a part of inner surface of sphere. |
| **Convex mirror** | **:** mirror, its reflecting surface is a part of outer surface of sphere. |

الملعقة مرآة مستوية : لان الجزء الداخلى مقعر – والخارجى محدب

**G.R:** The stainless-steel spoon is considered a spherical mirror: As its inner surface is a concave mirror, while its outer surface is a convex mirror.

مفاهيم المرآة الكرية 1- مركز تكور المرآة هى مركز الكرة التى تكون المرآة جزء منها (امام السطح العاكس فى المقعرة والخلف فى المحدبة) C
– 2- نصف قطر المرآة هو نصف قطر الكرة التى تكون المرآة جزء منها – 3- قطب المرآة هو نقطة تتوسط السطح العاكس للمرآة
4- المحور الاصلى: مستقيم يمر ب القطب والمركز 5- المحور الثانوى: مستقيم يمر ب المركز واى نقطة غير القطب
6- البؤرة: نقطة تجمع الاشعة فى المقعرة – او تجمع امتدادات الاشعة فى المحدبة F 7- البعد البؤرى : المسافة بين البؤرة والقطب
الصورة الحقيقية: يمكن استقبالها ع حائل – التقديرية : لايمكن استقبالها ع حائل

**Concepts related to the spherical mirrors:**

| | |
|---|---|
| **Center of mirror curvature** | center of sphere that mirror is a part of it. It lies (front reflecting surface in concave and behind in convex). |
| **Radius of mirror curvature** | : radius of sphere that mirror is a part of it. **Or:** distance between center of curvature and any point on surface. |
| **Pole of mirror** | : point, is in the middle of reflecting surface of mirror. |
| **Principal axis of mirror** | : straight line, passes by pole of mirror and its center of curvature. |
| **Secondary axis of mirror** | : straight line, passes by center of curvature and any point on its surface except pole of mirror. |
| **Focus of mirror** | : point of collection of ( reflecting light rays" in concave" – extensions of reflecting light rays" in convex"). |
| **Focal length of mirror** | : distance between focus and pole. ***F = 1/2 r.*** |
| **Real image** | : image, can be received on screen. |
| **Virtual image** | : image, can't be received on screen. |

- كل المرايا الكرية لها عدد لانهائى من المحاور الثانوية – لها محور واحد اصلى
- Each spherical mirror has uncountable number of Secondary axis and only one Principal axis.
-
- مسار الاشعة فى المرآة المقعرة : الشعاع الساقط موازى للمحور الاصلى ينعكس مارا بالبؤرة
- الشعاع الساقط مارا بالبؤرة ينعكس موازى للمحور الاصلى – الشعاع الساقط مارا بالمركز ينعكس ع نفسه
- **The image formed by the concave mirror:**

| **Path of incident ray** | Parallel to principal axis | Passing through the focus F | Passing through curvature centre C |
|---|---|---|---|
| | | | |
| **Path of reflected ray** | through the focus F | parallel to the principal axis | Reflects back on itself |

- **The incident ray parallel to principal axis – it reflect through the focus**
- **The incident ray pass through the focus – it reflect parallel to the principal axis**
- **The incident ray pass through the center – it reflect on itself**

- حالات تكون الصورة فى المرآة المقعرة
- 1- الجسم بعيد مثل الشمس – مكان الصورة عند البؤرة – خصائص الصورة حقيقية مصغرة (نقطة)
- 2- الجسم ع بعد اكبر من نصف القطر – الصورة ع بعد اكبر من البعد البؤرى واقل من المركز(بين البؤرة والمركز) – حقيقية مقلوبة مصغرة
- 3- الجسم عند المركز – الصورة عند المركز – حقيقية مقلوبة مساوية للجسم
- 4- الجسم بين البؤرة والمركز – الصورة ابعد من المركز – حقيقية مقلوبة مكبرة
- 5- الجسم ع بعد اقل من البعد البؤرى (بين البؤرة والقطب) – الصورة تتكون من امتدادات الاشعة خلف المرآة – تقديرية معتدلة مكبرة

- **The cases of formation of images by the concave mirror**:

| Object position | Very far (As: Sun) | distance after than radius | center of curvature | Between focus and center of curvature | Between focus and pole |
|---|---|---|---|---|---|
| **Image Pos** | At focus | greater than focal length | At center of curvature | After curvature center | Behind mirror |
| **Image Property** | Real- dot (tiny) | Real - inverted - small (diminished) | Real - inverted - equal | Real - inverted – enlarged (magnified) | Virtual - erect - magnified |

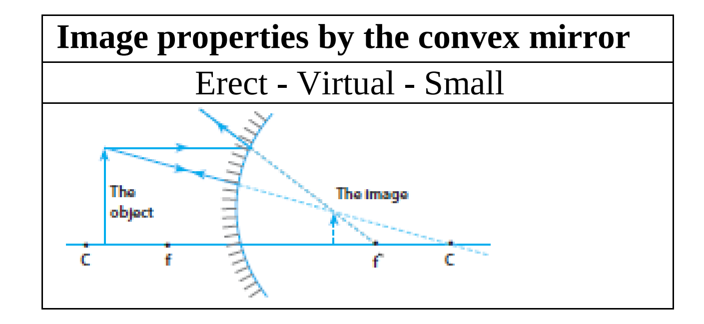
- استخدامات المرآة المقعرة : الكشاف – المصابيح الامامية للسيارة – فى الحلاقة – فى الفرن الشمسى – فى اماكن هبوط الطائرات – الفنار البحرى

- **Uses of concave mirror**:

- As a torch to reflect light - In front light of cars to reflect light - In shaving to get enlarged and erect image of face.
- In solar oven - In aircrafts landing - In marine lighthouses.

- الصورة المتكونة فى المرآة المحدبة : معتدلة تقديرية مصغرة

| Image properties by the convex mirror |
|---|
| Erect - Virtual - Small |




| Uses of convex mirror |
|---|
| - Used as side-view mirror in cars **(G.R):** As it forms an erect and smaller image for the way.<br>- Suitable for shops.<br>- Used in turning off the road<br>• تستخدم المرآة المحدبة فى السيارة لانها تكون صورة تقديرية معتدلة مصغرة ليتمكن السائق من رؤية الطريق كامل |

## *Lesson (2): Lenses*

- العدسات : وسط شفاف كاسر للضوء ذات سطحان كرويان

**The lens**: It's a transparent medium that refracts the light and is limited with two spherical surfaces.

- تستخدم العدسات فى النظارات الطبية – اصلاح الساعات – فى منظار الحروب – صناعة اجهزة العرض والكاميرا

| | | |
|---|---|---|
| **Uses of lenses** | 1- In medical eye glasses. | 2- Person who fixes watches use a magnifier lens. |
| | 3- In wars, leaders use binocular | 4- In manufacture of projector, cameras, and magnifying lenses. |

- انواع العدسات : مقعرة رفيعة فى الوسط وسميكة عند الاطراف – مفرقة للضوء – البؤرة (نقطة تجمع الاشعة) تقديرية – غير حقيقية
- محدبة : سميكة فى المنتصف ورفيعة عند الاطراف – مجمعة للضوء – البؤرة حقيقية

- **Types of lenses:**

| | **Concave lens** | **Convex lens** |
|---|---|---|
| **Structure** | Thin at center and thick at tips | Thick at center and thin at tips |
| **Effect on fall light rays** | Diverges | Converges |
| **Focus** | virtual | Real |

- مفاهيم لها علاقة ب العدسات

1- مركز تكور وجه العدسة هى مركز الكرة التى يكون وجه العدسة جزء منها

– 2—المركز البصرى للعدسة هو نقطة فى منتصف العدسة تقع ع المحور الاصلى 3- نصف قطر التكور هو نصف قطر الكرة التى تكون العدسة جزء منها

المحور الاصلى: مستقيم يمر ب مركزى التكور والمركز البصرى 5- المحور الثانوى: مستقيم يمر ب مركزى التكور للعدسة ما عدا المحور الاصلى 1-

6- البؤرة: نقطة تجمع الاشعة فى العدسة المحدبة – او تجمع امتدادات الاشعة فى المقعرة F 7- البعد البؤرى : المسافة بين البؤرة والمركز البصرى

- **Special concepts related to the lenses:**

| | |
|---|---|
| **Center of curvature of lens face** | : center of sphere, where this face is a part of it. |
| **Optical center of lens** | : point inside lens lies on the principal axis in the mid distance between its faces. |
| **Radius of curvature of the face of lens** | : half diameter of sphere, where this face is a part of it. |
| **Principal axis** | : straight line that joins between two centers of curvature of lens passing by optical center of lens. |
| **Secondary axis** | : any line passes by optical center of lens except principal axis. |
| **Focus of lens (principal focus)** | : point of collection of (refracted light rays in convex lens), or their extensions in concave lens. |
| **Focal length of lens** | : distance between focus and optical center of lens. |

**G.R: Lens has two centers of curvature and two foci:** because it has two circular surfaces.

**G.R: Thin lens has greater focal length than thick one:** as radius of thin lens is bigger than that of thick.

**G.R: Image formed by convex lens can be received on screen:** As it's a real image formed as a result of collection of refracted rays.

**G.R: Piece of paper can be burned by convex lens:** Because convex lens converge and direct sunlight in a point (focus).

- مسار الاشعة فى العدسة المحدبة : الشعاع الساقط موازى للمحور الاصلى ينكسر مارا بالبؤرة
- الشعاع الساقط مارا بالبؤرة ينكسر موازى للمحور الاصلى – الشعاع الساقط مارا ب المركز البصرى لا يعانى اى انكسار

**The path of rays falling on the concave lenses:**

| **Path of the incident ray** | parallel to the principal axis | through the focus | through optical centre of lens |
|---|---|---|---|
| | | | |
| **Path of the refracted ray** | through the focus | parallel to the principal | without refraction |

- **The incident ray parallel to principal axis – it refract through the focus**
- **The incident ray pass through the focus – it refract parallel to the principal axis**
- **The incident ray pass through the center – it pass without refraction**

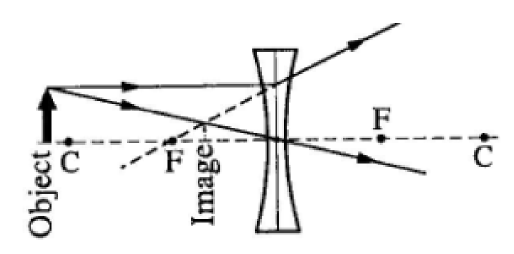
- **حالات تكون الصورة فى العدسة المحدبة**
- **1- الجسم بعيد مثل الشمس – مكان الصورة عند البؤرة – خصائص الصورة حقيقية مصغرة (نقطة)**
- **2- الجسم ع بعد اكبر من نصف القطر – الصورة ع بعد اكبر من البعد البؤرى واقل من المركز(بين البؤرة والمركز) – حقيقية مقلوبة مصغرة**
- **3- الجسم عند المركز(ضعف البعد البؤرى) – الصورة عند المركز – حقيقية مقلوبة مساوية للجسم**
- **4- الجسم بين البؤرة والمركز – الصورة ابعد من المركز – حقيقية مقلوبة مكبرة**
- **5- الجسم عند البؤرة – لا يتكون صورة لان الاشعة تنكسر متوازية**
- **6- الجسم ع بعد اقل من البعد البؤرى (بين البؤرة والمركز البصرى-امام العدسة) – الصورة– تقديرية معتدلة مكبرة**

**The cases of formation of images by the convex lens:**

| **Object** | Very far | More than radius | At twice focal length | Between focus and center | At focus | Smaller than focal length |
|---|---|---|---|---|---|---|
| | | | | | | |
| **I. position** | At focus | Between focus and center | At center of curvature | After curvature center | No image: refracted rays are parallel. | In front of lens |
| **I. Property** | Real- dot | Real - inverted - small | Real - inverted - equal | Real - inverted - enlarged | | Virtual - erect - enlarged |

- الصورة المتكونة فى العدسة المقعرة – تقديرية – معتدلة مصغرة

- **The image formed by the concave lens: virtual – erect - small**




- تستخدم العدسات فى : التلسكوب لتكوين صور مكبرة للاجسام الفضائية – الميكرسكوب لتكوين صور مكبرة للاجسام المتناهية الصغر
- فى النظارات الطبية ل علاج عيوب الابصار

**Applications on lenses: used in:**

1- **Telescopes:** to form enlarged images for heavenly bodies.
2- **Microscopes:** to form magnified images of tiny bodies.
3- **Making of medical glasses**: to treat vision defects.

- الرؤية : ينعكس الضوء ع قرنية العين لتتجمع الاشعة بالعدسة ع الشبكية – الشخص الطبيعى يرى الاجسام القريبة ع بعد 25سم – والبعيدة حتى 6م

- **The vision:**

- Light rays reflect from body to fall on eye. Light rays refract when passing through cornea then lens (convex lens).
- Refracted rays are collected on the retina forming a small, real inverted image.
- Diameter of eyeball is: distance between optical center of lens and retina.
- To see clearly, image must be formed on retina.
- Normal person can see clearly the:
    1- Near objects (at a distance not less than 25 cm).
    2- Far objects ( at distance up to 6 m).

**Use of lenses to treat vision defects:** استخدام العدسات فى علاج عيوب الرؤية - الابصار

| | **Near object** | **Far object** | **Position of image** | **Eyeball diameter- convexity of eye lens** | **Correction by using** |
|---|---|---|---|---|---|
| **قصر النظر**<br>**Short-sight** | Seen | Can't be seen | الصورة امام الشبكية<br>In front of retina | Increase | Concave lens |
| **طول النظر**<br>**Long-sight** | Can't be seen | Seen | خلف الشبكية<br>Behind retina | decrease | Convex lens |

- **G.R: Vision defects occur:** because eye cornea is not always convex or eye is not always spherical.

| | **Short-sightedness** | **Long-sightedness** |
|---|---|---|
| ***Definition*** | Near objects can be seen clearly but far objects seem distorted | Far objects can be seen clearly but close objects aren't seen clearly |
| ***Formed image*** | Image of far object fall in front of retina. | Image of close object fall behind of retina. |
| ***Reasons*** | **1-** Increase eyeball diameter: thus retina is far away eye lens<br>**2-** Increase convexity of eye lens: results smaller focal length so, far rays collected in front of retina<br>**زيادة قطر كرة العين – زيادة تحدب العدسة** | **1-** Decrease eyeball diameter: thus retina is close to eye lens.<br>**2-** Decrease convexity of eye lens: results more focal length so, near rays are collected behind retina<br>**نقص قطر كرة العين – قلة تحدب العدسة** |
| ***Correct:* Using** | **Concave lens**: to diverge rays so, image formed on retina | **Convex lens:** to collect rays so, image is formed on the retina. |

- **العدسات اللاصقة : عدسة بلاستيك تلصق ع قرنية العين عن طريق سائل العين**
- **Contact lenses**: plastic lens, stick to eye cornea by eye fluid.
- **Science, Technology and Society:**
  - **المياه البيضاء : السبب كبر السن – المرض – الاعراض الجانبية للادوية – استعداد وراثى – تسبب صعوبة الرؤية نتيجة اعتام عدسة العين**
  - **العلاج : التدخل الجراحى لاستبدال العدسة ب عدسة اخرى**

**Cataract disease**

**Reasons:** **1-** Old age. **2-** Illness. **3-** Side effects of drugs. **4-** Genetic readiness.

**Results:** Difficulty of vision due to darkness of eye lens.

**Treatment:** Surgery: to exchange eye lens with a plastic lens.

## Unit (3): Lesson (1): The Universe الكون

الكون هو الفضاء الذى به المجرات – النجوم الكواكب الاقمار والكائنات الحية

**The Universe:** Wide and extended space, contains all galaxies, stars, planets, moons, living organisms, and everything.

المجرة : مجموعة من النجوم تدور معا فى الفضاء بتأثير الجاذبية

**Galaxies**: Groups of stars that rotate together in cosmic space by effect of gravity.

كل مجموعة لها شكل مميز (مثل الابراج الفلكية) لانه يوجد توافق فى تنظيم مجموعات النجوم

- **G.R:** Each galaxy has distinctive shape: due to harmony and order of groups of stars in it.
- Galaxies gather in clusters. ( المجرات تتوزع فى شكل مثل العقد ( مجموعة من المجرات
- Clusters: groups of galaxies in the space.
- Our solar system belongs to "Milky Way galaxy". المجموعة الشمسية تتبع مجرة الطريق اللبنى او درب التبانة

- **In Milky Way galaxy:** النجوم الكبيرة تظهر فى منتصف المجرة – الحديثة ع الاطراف (اذرع المجرة) – الشمس نجم يدور حول مركز المجرة
  - Large stars are in center.
  - Recent small stars are in spiral arms.
  - Sun is a star rotates around center of Milky Way galaxy.
  - سميت ب الطريق اللبنى – لانها تشبه اللبن المسكوب

- **G.R: Milky Way galaxy is given that name:** As it appears in the sky at night as a splashing milk.

- المجموعة الشمسية : تتكون من الشمس و 8 كواكب تدور حولها – تقع ع اطراف المجرة – الشمس تدور دورة واحدة حول مركز المجرة فى 220مليون سنة

**The Solar system**: It's the sun and eight planets revolving around it.
- The Solar system: is located in one the spiral arms of the Milky Way galaxy on the edge of the galaxy.
- The Sun takes about 220 million years to complete one rotation around the center of the galaxy.
- The Earth: It's the planet of life. الارض كوكب الحياة – تستخدم السنة الضوئية لقياس المسافات بين الكواكب (مسافات كبيرة جدا)
- We use Light year to measure distances in the far space between stars where distances are very large.
- السنة الضوئية هى المسافة التى يقطعها الضوء فى سنة

**Light year**: It's the distance covered by light in one year and it equals $9.467 \times 10^{12}$ km.

- **What is meant by**:
  - The distance between the Sun and a star is **3** light years: means that the distance between the Sun and this star = $3 \times 9.467 \times 10^{12} = 28.401 \times 10^{12}$ km.

تمدد الكون : هو الزيادة المستمرة فى الفواصل بين المجرات – بسبب الحركة المستمرة للمجرات فى الكون

- **Expansion of the universe**: It's the continuous separation between galaxies.
- **G.R**: Continuous Expansion of the space: Due to continuous motion of galaxies in the universe.
- نظرية الانفجار العظيم : ان الكون نشأ نتيجة انفجار هائل حدث قبل 15000مليون عام نتج عنه كل انواع المادة والطاقة والزمن

**Big Bang**: It's a massive explosion happened, since 15000 million years, resulted in it all forms of matter, energy and time.

منذ حوالى 15000 مليون سنة كان الكون ضئيل الحجم جداً وحاراً جداً ، بالأنفجار العظيم ادى الى التمدد والتغيير ، فخلال دقائق من حدوث الأنفجار أخذت الجسيمات الذرية بالتلاحم مكونة غازى الهيليوم والهيدروجين اللذين أنتجا المجرات والنجوم والكون عبر ملايين السنين

**OR:** It's the expansion of the universe and merging of atomic particles forming helium and hydrogen gases **which produced galaxies, stars and the universe**

| | |
|---|---|
| **The Big Bang** | **The process of expansion and changing of the gaseous ball components stared and it continues to this day** |
| **After explosion** | **Temperature was about 1000000 million degrees** |
| **Within minutes** | **The universe was formed containing 75% hydrogen and 25% helium.** |
| **After 1000 million years of the Big Bang.** | **Matter got joined in masses** |
| **within 2000 to 3000 million years of the Big Bang** | **Ancestral galaxies were evolved** |
| **After 3000 million years after the Big Bang.** | **Galaxies began to form** |
| **after 5000 million years** | **Our galaxy, the Milky Way, took its disc form** |
| **after 100000 million years of the Big Bang** | **The Sun was born and then the Earth and planets were created.** |
| **after about 12000 million years of the Big Bang** | **Earliest life forms began to appear on earth** |
| **15000 million years after the Big Bang** | **The universe as it now** |

- Universe was originated since 15 billion years.

مستقبل الكون اختلف العلماء حول نظريات هذا الموضوع. البعض منهم يؤمنون نظرية الكون المفتوح. يرون أنه لا يوجد حد نهائي لهذا الكون. في حين أولئك الذين يؤمنون بنظرية الكون المغلق نرى أن الكون سوف يتوقف التوسع وسوف يكون مضغوط جدا أو حار جدا، كما بدأ وتستعد لانفجار كبير جديد.

**Future of the universe**

**Scientists have different theories about this subject.**

| **the opened universe theory** | **the closed universe theory** |
|---|---|
| **The scientists see that there is no definite end to the universe** | **believe in see that the universe will stop expanding and will begin to contract until it becomes very compact or very hot, preparing for a new Big bang.** |

## *Lesson (2): The Solar System*

**المجموعة الشمسية تتكون من الشمس (الحجم الاكبر) 8 كواكب – مذنبات – اقمار – كويكبات (نواتج انفجارات كواكب – احجار)**

- The solar system consists of: Sun (represents 99%)- eight planets – Comets – Moons - Asteroids.
- Solar system extends over 12 billion kms in space. **تمتد حوالى 12 بليون كم فى الفضاء**
- Planets were originated since 4600 million years ago. **الكواكب نشأت من 4600 مليون عام**
- **قانون نيوتن للجاذبية : قوة الجذب بين جسمين تتناسب طرديا مع حاصل ضرب كتلتهم وعكسيا مع مربع المسافة بينهما**

**Newton's law of universal gravitation**:
force of attraction between two bodies is directly proportional to product of their masses and is inversely to the square of the distance between them.

**الجاذبية تعمل ع دوران الكواكب حول الشمس فى مدارات ثابتة – تماسك مادة الاجسام الفضائية**

**Gravitational force makes:**

**1-** Planets revolve around the Sun in fixed orbits.
**2-** The matter of each celestial body remains firm.
**3-** **قوة الجذب المركزية : هى القوة التى تعمل ع استمرار دوران الكواكب فى مدارات حول الشمس**

**Central Gravitational force:** It's the force that keeps the continuity of the planets rotating in their orbits around the sun.

- **ماذا يحدث لا يوجد جاذبية : الارض تترك المدار وتطفو فى الفضاء مما يؤدى الى دمارها – المصعد يصبح بدون وزن – الانسان بدون وزن**
- **What happens if**: there is no attraction force: Earth will leave its orbit and float in a random fashion in the space leads to destruction of the Earth.
- **What happen if**: the lift falls when wires are cut: you feel weightlessness.
- **What happen if**: you are inside the lift falls fast: you feel that you are lighter in weight.
- **نظريات نشأة الكون**
- **Theories about the evolution of solar system:**
- **Solar nebular model:** sun was surrounded by solar nebula (**Gases**: helium and hydrogen **– Dust:** iron, rocks and ice).
- أقترحت نظرية السديم ( لا بلاس 1796 )أن المجموعة الشمسية نشأت على النحو التالى :
- *** كانت المجموعة الشمسية فى الأصل عبارة عن كرة غازية متوهجة تدور حول نفسها (السديم) بمرور الزمن فقد السديم حرارته تدريجياً فنقص حجمه وزادت سرعة دورانه حول نفسه * تحت تأثير القوة الطاردة فقد السديم شكله الكروى وأصبح له شكل قرص دوار مسطح . أنفصلت عنه أجزاء غازية بعدما بردت وتجمدت كونت كواكب المجموعة الشمسية ، وشكلت الكتلة الملتهبة فى المركز الشمس**

**Nebular theory: (Laplace):**

**"Nebula":** It's a glowing gaseous sphere revolving around itself, from which the solar system was originated.

1- Over the time, nebula lost its heat, so its size contracted and its revolving speed around itself increased.
2- Under effect of centrifugal force. Nebula turned into a flat rotating disk and parts separated from it to form gaseous rings.
3- The gaseous rings cooled down and frozen forming the planets of the solar system. The flaming mass in the centre formed the "Sun".

- نظرية النجم العابر : * كانت المجموعة الشمسية فى الاصل عبارة عن نجم كبير واحد هو الشمس . * أقترب من الشمس نجم عملاق .* قام بجذب الشمس نحوه مما سبب تمدداً كبيراً فى جزء الشمس مكونا سحابة غازية انفصلت وبردت مكونة الكواكب .

**The crossing star theory: (Chamberlain and Molten):**

1- A huge star approached to the Sun and attracted it, which led to an expansion in a part of the Sun.
2- This expanded part was exploded which led to formation of a great gaseous line and the Sun escaped from star's gravity.
3- The gaseous line condensed due to attraction force, then it cooled forming the planets.

* وجود نجم يدور بالقرب من الشمس . * تعرض النجم للأنفجار بفعل تفاعلات نووية ضخمة .* أدت قوة الأنفجار لطرد نواة هذا النجم بعيداً عن جاذبية الشمس والجزء الباقى من النجم كون سحابة غازية بردت وكونت الكواكب

**1-** A star was rotating near the Sun.
**2-** The star exploded due to huge nuclear reactions. This led to bombing of star's nucleus away from the Sun's gravity and a cloud of gas remained.
**3-** Gaseous cloud cooled and contracted forming planets and attraction force of Sun controlled the orbits.

**The difference in the length of the day and year from a planet to another:**

| اليوم دورة الارض حول نفسها **Earth's day**: | السنة دورة الارض حول الشمس **Earth's year**: |
|---|---|
| time taken by Earth to complete one rotation around its axis | time taken by Earth to complete one rotation around Sun |

اختلاف طول اليوم والسنة من كوكب لاخر : اليوم يختلف نتيجة اختلاف نصف قطر وسرعة دوران الكوكب حول نفسه
السنة تختلف لاختلاف المسافة بين الكوكب والشمس – سرعة دوران الكوكب حول الشمس

| **Factors affecting day length** | | **Factors affecting year length** |
|---|---|---|
| **1-** Radius of the planet. | | **1-** Distance between the planet and the Sun. |
| **2-** Planet rotation speed around axis | | **2-** Planet rotation speed around the Sun. |

| Planet | Rotation around the axis (earth's day) | Rotation around the Sun (earth's year) |
|---|---|---|
| Mercury | 59 | 0.24 |
| Venus | 243 | 0.62 |
| Earth | 1 | 1 |
| Mars | 1.03 | 1.9 |
| Jupiter | 0.41 | 12 |
| Saturn | 0.43 | 29 |
| Uranus | 0.72 | 84 |
| Neptune | 0.67 | 165 |

| | | | |
|---|---|---|---|
| **longest day: Venus** | **longest year: Neptune** | **shortest day: Jupiter** | **shortest year: Mercury** |

الاجهزة المستخدمة فى استكشاف الفضاء : التلسكوب الشمسى الفكرة انعكاس اشعة الشمس عل مراة ف نفق تحت الارض وتتكون صورة الشمس لدراسة الطيف الشمسى

- **The important instruments:**

1- **The solar telescope:** it forms a picture of the Sun. It works on reflecting the Sun rays to a mirror in a tunnel under the Earth's surface. Sunlight is gathered, then separated into a solar spectrum by the spectrometer which shows the wave lengths of the Sun.

٢ ـ التلسكوب : يدور حول الارض فى مدار معين يعطى صورة واضحة للاجسام الفضائية – يلتقط اشعة لا تصل للارض

3- **Telescopes:** rotating in orbits around Earth are better than that are been on the surface of Earth because:

- They can see celestial bodies more clearly. - They catch rays that can't be able to penetrate the Earth's atmosphere.

مثل تلسكوب هبل : التعرف ع تطور الكون بعد الانفجار العظيم

**Ex: Hubble telescope:** Collects photos for the universe since millions of years to study evolution of the universe after Big Bang.

سفن الفضاء تدور حول الكواكب الاخرى لاكتشافها

4- **Spacecrafts:** revolve around other planets to send discoveries.

## التكاثر وانقسام الخلية Unit (4): Reproduction – Lesson (1): Cell division

- **Types of cells**:
- انواع الخلايا – جسدية (الكبد-الجلد-الكلية) (الجذور-الساق- الورقة فى النبات) – خلايا تناسلية (الخصية والمبيض) – المتك والمبيض فى النبات

1- **Somatic cell: such as:** (liver-skin-kidney) in the human and animals - ( root-stem- leaf) in the plants.

2- **Reproductive cell: such as:** (testis – ovary) in the human and animals – (Anther-ovary) in plants.

٣ - الخصية (انتاج الحيوانات المنوية) المبيض انتاج البويضات – المتك انتاج حبوب اللقاح

- **Testis:** produce sperms. - **Ovary:** produce ova. - **Anther:** produce pollen grains. - **Ovary:** produce eggs.

- النواة مسئولة عن انقسام الخلية لان بها المادة الوراثية (الكروموسومات)
- The cell nucleus is the responsible for cell division: Because it contains genetic material of living organism (chromosomes).
- الكروموسوم : جسم خيطى فى النواة وتحتوى ع المادة الوراثية – كل كروموسوم ينقسم الى 2كروماتيد مثبت كل منهم ب الاخر ب السنترومير
- **Chromosome:** thread like bodies present in cell's nuclei and represent genetic materials of living organism.
- Chromosome: consists of: 2 threads (chromatids) connected at point (Centromere).
- السنترومير نقطة اتصال ال 2 كروماتيد – كل كروماتيد يتكون من حمض نووى (يحمل الجينات التى تحمل الصفات الوراثية) - بروتين
- **Centromere:** point of connection of 2 chromatids of chromosome during cell division.
- Each chromatid consists of: DNA (which carries the genes that carry the genetic traits) - Protein.
- الحمض النووى: المكون الاساسى للكروموسوم ويحمل الجينات
- **DNA:** nucleic acid, forms chromosomes that present in cell's nucleus and it carries the genes.
- عدد الكروموسومات فى الخلايا الجسدية 46 ضعف العدد فى الخلايا التناسلية 23
- Number of chromosomes in somatic cells is a diploid number (2N): 1 inherited from father, 1 from mother.
- Number of chromosomes in gametes is a haploid number (N): male gamete (sperm) - female gamete (ova).
- All somatic cells contain 46 chromosomes, while the gametes (sperms or ova) contain 23 chromosomes.

- انواع انقسام الخلية :

| | |
|---|---|
| • انقسام ميتوزى: يحدث فى الخلايا الجسدية – لنمو الكائن الحى وتعويض الانسجة التالفة | • انقسام ميوزى: يحدث فى الخلايا التناسلية – لتكوين الحيوان المنوى او البويضة |
| • قبل البدء فى الانقسام يبدأ الطور البينى : للتحضير للانقسام – يتضاعف الحمض النووى لتكون الخلايا الناتجة بها نفس عدد الكروموسومات للخلية الاصلية | |
| • مرحلة واحدة – 4 اطوار | • مرحلة اولى – 4 اطوار – مرحلة ثانية |
| • الطور التمهيدى تتجمع الشبكة الكروماتينية مكونة خيوط المغزل – تختفى النوية والغشاء النووى | • الطور التمهيدى الاول : يتقارب كل كروموسومين مكونة المجموعة الرباعية 4كروماتيد<br>• تحدث ظاهرة العبور: وهى تبادل اجزاء من الكروماتيدين الداخلين لانتاج صفات جديدة |
| • الطور الاستوائى : تتجه الكروموسومات الى خط الاستواء بالخلية | • الطور الاستوائى الاول: تترتب ازواج الكروموسومات فى صورة المجموعة الرباعية ع خط الاستواء |
| • الطور الانفصالى: ينقسم السنترومير تنفصل الكروماتيد(احادى) الخيوط تنكمش – كل كروموسوم يتجه الى قطب الخلية | • الطور الانفصالى الاول: تنفصل ال 2 كروموسوم ناحية قطبى الخلية |
| • الطور النهائى: الخيوط تختفى تتكون نواة جديدة وغشاء نووى تنقسم الخلية الى 2 بها نفس عدد كروموسومات الخلية الاصلية | • الطور النهائى الاول: يتكون خليتين بهم نصف عدد الكروموسومات لدخول الانقسام الميوزى الثانى لتكوين 4 خلايا بها نصف عدد الكروموسومات |

**Types of cell division:**

| Point of comp | Mitoses – Mitotic | Meiosis – Meiotic |
|---|---|---|
| **Location in:** | Somatic cell | Reproductive cell (gonads) |
| **Importance** | living organism growth - Damaged cell compensation | Gametes formation |
| Cell passes before starting division by: **Interphase: 1-** To prepare for division through some important biological processes. **2-** (DNA) duplicates.<br>**G.R: DNA duplicates:** to make resulted cells have same number of chromosomes. | | |
| **Stages** | 1 stage - 4 phases | 2 : first – second meiotic division |
| **(1) prophase** | - Chromatin reticulum condenses<br>- Spindle is formed<br>- Nucleolus and nuclear membrane disappear.<br><br>**(Note):** Spindle is formed from centrosome in animal cell, while from condensing cytoplasm in plant cell) | - Homologous chromosomes are arranged in pairs, pair consists of 4 chromatids (tetrad)<br><br>- **Crossing over:** occuurs<br>It's a phenomenon that takes place at the end of prophase 1, in which some parts of two inner chromatids of each tetrad are exchanged to produce new genetic arrangements. |
| **(2) Metaphase** | Chromosomes are arranged along cell equator | |
| **(3) Anaphase** | - Centromere splits so chromatids separate. (single)<br>- Spindle shrink:<br>***As*** two groups of separated chromosomes migrate to cell's poles | Each 2 chromosomes move away from each other towards two poles. |
| **(4) Telophase (adverse changes)** | - Spindle disappear<br>- Nucleolus and nuclear membrane are formed.<br>- The cell divides into two new cells. | Two cells are formed and each of them enters second meiotic division and produce 2 other cells, each of them has half number of parent's chromosomes. |
| **Resulting cells** | 2 | 4 |
| **Chrom. number** | contains same number of parent's chromosomes. | contains half number of parent's chromosomes. |

اهمية ظاهرة العبور: تنوع واختلاف الصفات الوراثية للاجيال الناتجة لانها تعمل ع تبادل الجينات فى الكروموسومات المتشابهة

**Importance of crossing over**:

It works on variation of genetic traits among members of same species, where it contributes in genes exchanging between two homologous chromosome's chromatids and distributes them randomly in the gametes

- **Nanotechnology and cancer treatment**:

1- **Discovering cancer disease**:
   - loading proteins with Nano-molecules of gold and injecting them into the patient blood
   - Protein attach on the cancerous cell surface to monitor it through a microscope.

2- **Treatment of cancer**:
   - By using Nano-molecules of gold: focusing laser to gold molecules which absorb the light and converts it into heat burn infected cells
   - By using developed micro scoping bombs: that penetrate the cancer cells and explode them.

## التكاثر الجنسى – التكاثر اللاجنسى *Lesson (2): Sexual and Asexual Reproduction*

التكاثر عملية حيوية لانتاج افراد جديدة من نفس النوع لحماية النوع من الانقراض

التكاثر اللاجنسى : من فرد ابوى واحد ذات صفات وراثية مشابهة تماما للفرد الابوى

| | |
|---|---|
| **Reproduction process** | : biological process, where living organism produces new individuals of same kind and ensuring continuity. |
| **Asexual reproduction** | : process by which living organisms produce new individuals with genetic traits identical to their parents. |

**Types of Asexual:**

الانشطار الثنائى : عن طريق الانقسام الميتوزى يعطى خليتين وتختفى الخلية الام فى الكائنات وحيدة الخلية مثل الاميبا – الطحالب – البكتيريا

1- **Binary fission:** the cell divides by mitoses division giving two cells and parent cell disappear

**In: Unicellular protozoans (Amoeba– Euglena–Paramecium) – Simple algae – Bacteria.**

التكاثر بالتبرعم : عن طريق تكوين براعم فى الخلية الام يحدث فى الكائنات وحيدة الخلية ( مثل فطر الخميرة ) والكائنات عديدة الخلايا مثل ( الهيدرا والإسفنج )

2- **Budding:** Produce new individuals by forming buds in parent cell

**In: Unicellular (Yeast) –Multiellular (Hydra- Sponge).**

البرعم ينمو ثم ينفصل مكونا مستعمرة

**A bud grows and remains connected to the parental cell until it is fully grown then separates from it or remains to form a colony**

٣ - التجرثم : عن طريق تكوين الجراثيم – عفن الخبز المشروم – بعض الطحالب

3- **Sporogony (Spore propagation):** Produce new individuals by forming spores.

**In: Bread mould- Mushroom – some algae.**

التجدد هو قدرة بعض الحيوانات على تعويض الأجزاء المفقودة منها ، حيث يتكاثر الكائن الحى عن طريق أحد أجزائه ، ذراع نجوم البحر يمكن أن تتجدد وتعطى حيواناً كاملاً إذا أحتوت على جزء من القرص الوسطى للحيوان

4- **Regeneration:** Ability of animals to compensate their missing parts, and the lost arm if has a part of central disc so, it forms a complete individual.

**In: Starfish**

التكاثر الخضرى : -بعض النباتات تتكاثر خضرياً بدون الحاجة إلى بذور ، وذلك بواسطة الأعضاء النباتية المختلفة كالآوراق والجذور والسيقان أو من الأنسجة النباتية والخلايا ( زراعة الأنسجة ) وذلك لإنتاج نباتات جديدة مشابهة تماماً للنبات الأم ، ويتضمن التكاثر الخضرى فى النبات أنقساماً ميتوزياً .

**Vegetative reproduction: Vegetative organs without needing seeds by their vegetative organs and the cells (tissues culturing) in order to produce new plants very similar to the parent plant. Vegetative propagation in plants includes cell's mitotic division.**

التكاثر الجنسى : انتاج افراد ذات صفات وراثية مختلفة عن الاباء (مشتركة من ابوين)

**Sexual reproduction**: process by which living organisms produce individuals with genetic traits differ from parents.

**Sexual reproduction:** depends on 2 processes: 1- Gametes formation. تكوين الخلايا المذكرة والمؤنثة 2- Fertilization **الاخصاب**

الاخصاب (اندماج الخلية المذكرة مع المؤنثة لتكوين الجنين الذى يحتوى ع نفس العدد من الكروموسومات – الجنين ينتج من الاخصاب ويحتوى عدد الكروموسومات كاملة

**Fertilization:** combination of male gamete and female gamete to form zygote, which contains normal number of chromosomes of living organism.

**Zygote**: cell produced due to fertilization and it contains complete number of chromosomes of living organism.